

DIESEL PARTICULATE FILTERS USED IN UNDERGROUND COAL MINES

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PARTICULATE FILTRATION THEORY



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CHOICES FOR DPM REDUCTION

“THERE IS NO SILVER BULLET”

- Maintenance
- Cleaner Engines
- Diesel particulate filters (soot traps)
 - Passive
 - Active
- Disposable diesel particulate ‘paper’ filters
- New synthetic media filters

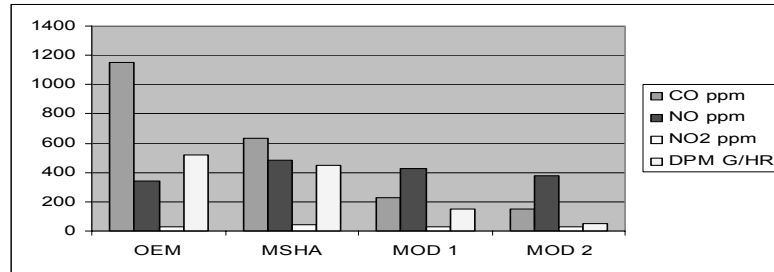
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HOW BIG OF DIFFERENCE CAN MAINTENANCE MAKE?

- In 1997 CFC’s fleet average concentrations of gases in raw exhaust were
 - 1597 ppm carbon monoxide
 - 997 ppm NO_x
- In 2003 CFC’s fleet average concentrations of gases in raw exhaust are
 - 158 ppm carbon monoxide
 - 458 ppm NO_x

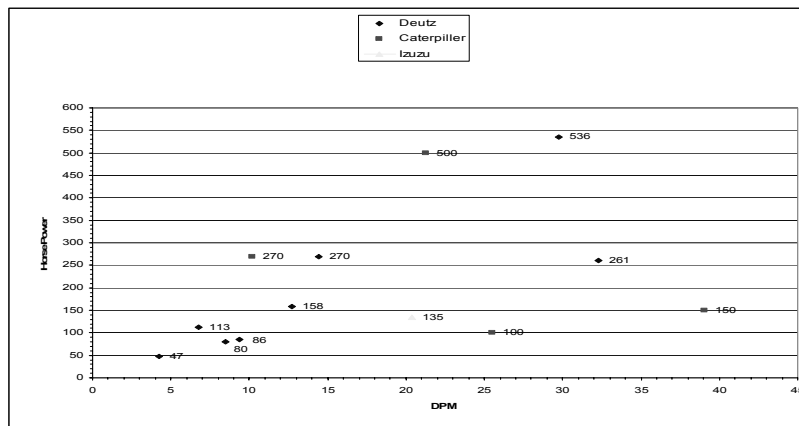
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THE EFFECTS OF ENGINE TUNE ON THE EMISSIONS



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Cleaner Engines



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PASSIVE “Highly Catalyzed” SOOT TRAP

- The trap should regenerate itself
- The systems needs to be monitored for back pressure
- NO₂ might be a problem
- Relatively low cost

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PASSIVE “Highly Catalyzed” SOOT TRAPS



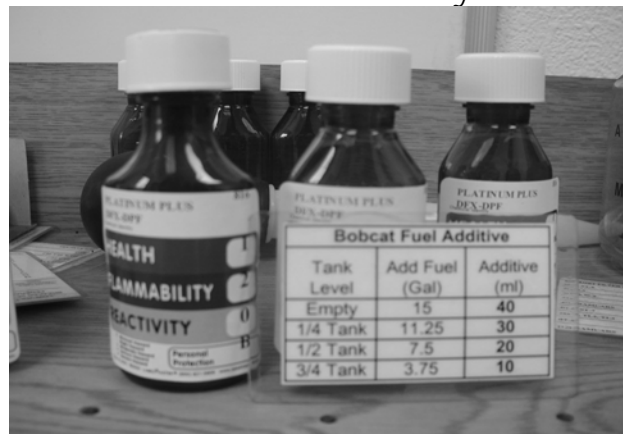
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PASSIVE “Highly Catalyzed” SOOT TRAPS

- PIB 02-04 warning about NO₂ production from platinum catalyzed soot traps for both metal/non metal and coal mines
- PIB 02-07 notice for coal only! Traps shall not increase NO₂ emissions

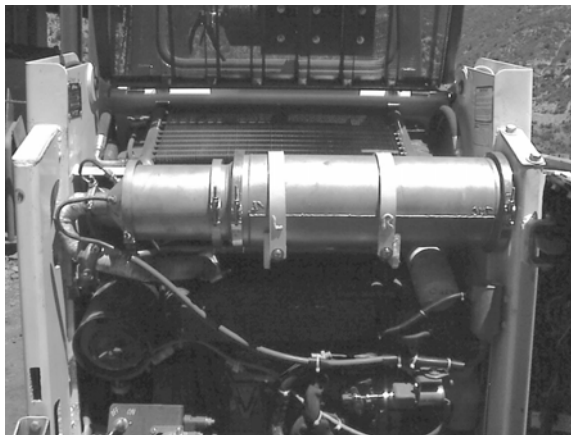
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Clean Air Lightly Catalyzed With Fuel Catalyst



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Clean Air Lightly Catalyzed With Fuel Additive



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ECS Base Metal “Cat Trap”



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ACTIVE SOOT TRAP

- No NO₂ production
- Require space where filters can be regenerated safely
- Some systems will need a power supply
- Designed to trap soot during one or more shifts
- Relatively high cost

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Active On-Board DCL



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Active Off-Board ECS



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Active Off-Board ECS



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DCL New On-Board Design



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DCL New On-Board Design



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EVALUATION OF DPF SYSTEMS IN COAL MINES

- Passive systems “Highly Catalyzed”
 - High NO₂
- Active systems
 - No NO₂ problems
 - Needs some way of regeneration
 - Can be used for one shift only
 - Need a place for regeneration

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DISPOSABLE DIESEL PARTICULATE ‘PAPER’ FILTERS

- Heat exchanger
 - Wet (water scrubber and make-up tank)
 - Dry (air-to-water)
- Filter holder + ‘paper’ filter element
- Water separator (optional)
- Designed for in-by coal vehicles
 - Exhaust temp. Requirements (cooled exhaust)
 - Surface temp. Requirements (water jacketed exhaust manifold)
- High installation cost

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DISPOSABLE DIESEL
PARTICULATE ‘PAPER’ FILTERS -
DRY SYSTEM “DST”



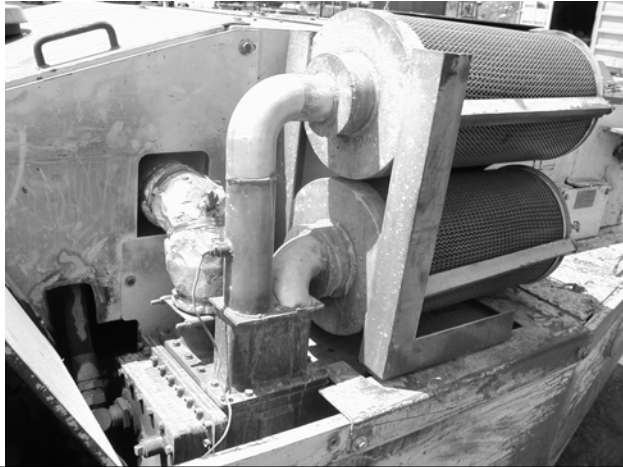
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DISPOSABLE DIESEL
PARTICULATE ‘PAPER’ FILTERS –
DRY SYSTEM “Getman”



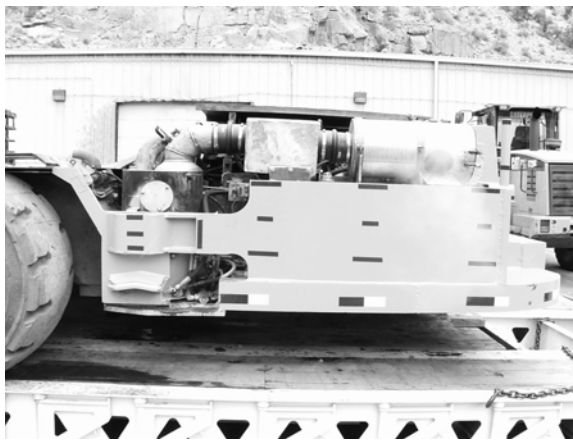
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DISPOSABLE DIESEL PARTICULATE ‘PAPER’ FILTERS – DRY SYSTEM “Getman”



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DISPOSABLE DIESEL PARTICULATE ‘PAPER’ FILTERS - WET SYSTEM



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DISPOSABLE DIESEL PARTICULATE 'PAPER' FILTERS

- Advantages
 - Relative simple to replace filter
- Disadvantages
 - Complex and expensive
 - Potential for fire
 - Short filter life
 - Wet system require maintaining water level in scrubber
 - Dry system require frequent heat exchanger cleaning

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EVALUATION OF DISPOSABLE FILTERS

- Not all media has adequate properties
 - Most of the filters available on market are designed as air intake filters
- Tests showed low efficiency of certain filter media
 - Confusion
 - Use only verified media
- Fire hazard

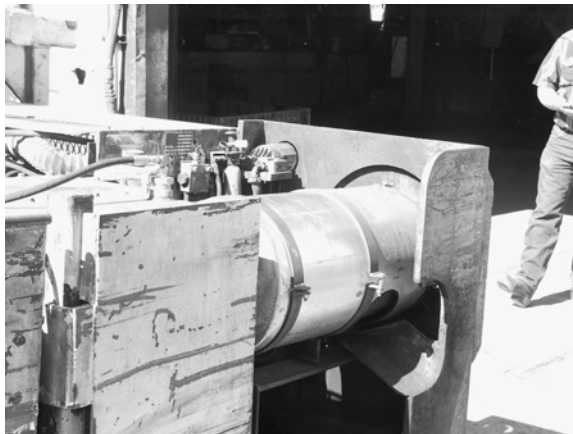
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Disposable synthetic filters

- Non Combustible
- Not effected by water
- Cleanable
- Can be used in both in-by and out-by

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Wet system (Cooled Exhaust) Permissible



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Un-cooled Exhaust Heavy-Duty Out by



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Disposable Synthetic Filter



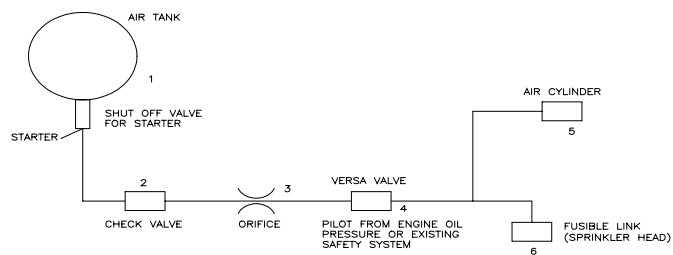
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Disposable Synthetic Filter



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Secondary shut down system



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Fusible Link shut down valve



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RETROFITTING DIESEL ENGINES OPERATED ON HIGH ELEVATIONS WITH DPFs

- **Naturally aspirated engines should be adjusted for altitude prior to retrofitting them with DPFs**
 - DPM and gaseous emissions are significantly affected by altitude
 - DPF system will be overwhelmed by DPM

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Effect of Elevation on Electronic Controlled and Turbo Charged Engines

The jury is out. Will there be a derated and at what elevation and how much. Or does the ECM and turbo truly adjust for elevation. How much support if any will be given by the engine builders.

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QUESTIONS?

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